Notice of Allowability	Application No.	Applicant(s)	
	10/621,271	MAISOTSENKO ET AL.	
	Examiner	**Art Unit**	
	Ehud Gartenberg	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *papers filed through 8/22/2005*.
2. ☒ The allowed claim(s) is/are *1-59*.
3. ☒ The drawings filed on *17 July 2003* are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 7/17/03&11/11/04
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other *Fax 08/22/2005*.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Francis Conte on 8/22/2005.

The application has been amended as follows: Claim 1 has been amended as follows: on l. 5 of the claim, "therewith" has been changed to -- with said first main flow channel --.

Allowable Subject Matter

2. Claims 1-59 are allowed.

3. The following is an examiner's statement of reasons for allowance: prior art does not teach in combination with the other limitations of claim 1, a driveshaft and means for extracting energy from a hot gas stream connected to said driveshaft.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Maisotsenko 20050056029.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ehud Gartenberg whose telephone number is 571 272 4828. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Thorpe can be reached on 571 272 4444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ehud Gartenberg
Primary Examiner
Art Unit 3746

08222005

PATENT
Docket 23Idalex11

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: V. S. Maisotsenko et al

Application No.: 10/621,271
Confirmation No: 3042

Filed: 07/17/2003

Art Unit: 3746

Examiner: Gartenburg, E.

Title: **Power System and Method**

Missing Reference

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

On Aug 22nd, examiner Gartenburg phoned this attorney to locate the Dalili reference listed at AU on page 2 of the IDS form 1449 filed with the original application.

Accordingly, in accordance with both Rule 97, before the first office action on the merits, applicants enclose herewith a true copy of the Dalili reference (AU) for due consideration by the examiner.

In accordance with Rule 10, the undersigned attorney further petitions for consideration of this reference, as previously submitted to the USPTO; and hereby states that further attached to this paper are true copies of the originally mailed correspondence: (1) the transmittal form PTO/SB/05 bearing the requisite Express Mail number, and listing at numeral 12 the IDS and copies of IDS citations; (2) page 2 of the IDS form 1449 as filed; (3) the return postcard date stamped with the 7/17/03 filing, and listing at item "10" all the references listed in the PTO-1449; and (4) the seven-page Dalili reference (AU); along with a true copy of the Express Mail label with the official notation entered

PATENT
Docket 23Idalex11

by the USPS.

This paper is being faxed to the examiner at 571-273-4828.

Respectfully submitted,

Date: 22 August 2005

Francis L. Conte
Registration No. 29,630
Attorney for Applicant

6 Puritan Avenue
Swampscott, MA 01907
Tel: 781-592-9077
Fax: 781-592-4618

Attachments

PAGE 2/13 * RCVD AT 8/22/2005 2:21:31 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/25 * DNIS:2734828 * CSID:7815924618 * DURATION (mm-ss):05-50

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IECEC'01
36th Intersociety Energy Conversion Engineering Conference
July 29- August 2, 2001, Savannah, Georgia

2001-CT-05

FIRST EXPERIMENTAL RESULTS ON HUMIDIFICATION OF PRESSURIZED AIR IN EVAPORATIVE POWER CYCLES

Farnosh Dalili , Mats Westermark

Department of Chemical Engineering and Technology
Energy Processes
Royal Institute of Technology
S-100 44 Stockholm, Sweden
Phone: +46 8 7906000 , Fax: +46 8 7230858
E-mail: farnosh@ket.kth.se

ABSTRACT

Humidification of compressed air before combustion is a key operation in evaporative power cycles. However, little work has been done to study this operation at high pressures and temperatures. A tube humidifier pilot plant was designed and constructed to fill this void.

Experiments at different pressures and flow conditions have been carried out. The results show that the theoretical design methodology developed parallel with the experiments can be considered reliable. The tube dimensions and design gave satisfactory efficiencies regarding the flue gas cooling and the humidification of compressed air. Furthermore the results show a new behavior of the working line, which may have an impact on designing such equipment.

This paper mainly describes the pilot humidifier facility and its components and the first results obtained.

NOMENCLATURE

C	Molar concentration [kmol/m^3]
h	Individual heat transfer coefficient [W/m^2 °C]
h_D	Mass transfer coefficient [m/s]
h_{lat}	Latent heat transfer coefficient [W/m^2 °C]
i	Enthalpy of humid air per unit mass of dry air [kJ/kg]
i^*	Enthalpy of saturated air per unit mass of dry air [kJ/kg]
T	Temperature [°C]
ω	Humidity [g water vapor/kg dry air]
M	Mass flow rate [g/s]
M_w	Molar weight of water [kg/kmol]
N	Overall rate of mass transfer [kmol/s, m^2]
P	Total pressure [bar]

Subscripts

a	Compressed air
d	wet-bulb
i	Water-air interface
v	Water vapor
w	Water

INTRODUCTION

The gas turbine market has expanded rapidly during the last decade. Only between 1999 and 2000, the number of gas turbine units ordered increased by 37 percent (McNeely 2000). The technical development of gas turbines is towards higher inlet temperatures (TIT) and more complex systems by introduction of inter-cooling, multi-stage combustion, and exhaust heat recovery implementations. These implementations include recuperation, steam generation, humidification and condensation. The exhaust gas from the turbine usually has a temperature above 500°C. Hence, exhaust heat recovery is the key to high electrical and overall efficiencies. The combined cycle is an approved approach to gain high efficiencies. However, steam turbines are expensive and not available for small gas turbines. Other alternatives with similar performance are advanced gas turbine cycles e.g. the steam injected gas turbine (STIG) and the evaporative gas turbine (EvGT). The STIG cycle as well as the combined cycle recovers high-quality heat, i.e. down to temperatures above the boiling point, in the heat recovery steam generator (HRSG). The EvGT cycle even recovers low-quality heat, i.e. to temperatures far below the boiling point, in a humidifier.

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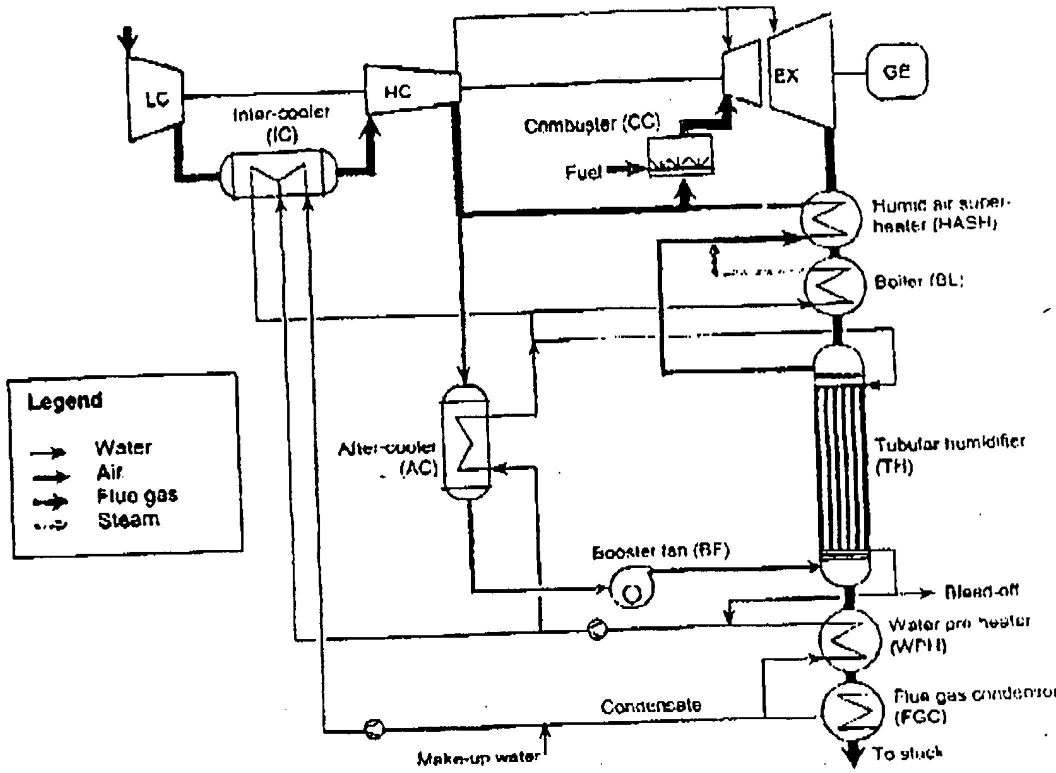

Figure 1. Proposed evaporative gas turbine cycle with tubular humidifier

The first evaporative gas turbine pilot plant (600 kW), located at the Lund Institute of Technology in Sweden, has been operating successfully since 1998. Invaluable experience is obtained from that plant, (Lindquist 1999) and (Ågren 2000). One key component in EvGT cycle is the humidification apparatus. Though the humidification process at atmospheric conditions is well known and practiced, e.g. in cooling towers, only little experimental data are available at high pressures and temperatures. These data are necessary for designing the humidification equipment. Therefore a separate project was initiated at the Royal Institute of Technology in Stockholm, to build up a firm understanding of the humidification process and to provide reliable procedure for designing such equipment.

This paper presents first experimental results from a humidifier pilot plant. A comparison is made between these experimental results and simulation results to validate the design procedure developed by the authors.

THE EVAPORATIVE POWER CYCLE

The EvGT power cycle, also referred to as the HAT cycle, was first presented in the mid 80s, (Nakamura et al., 1985, 1987) and (Rao 1989). The EvGT power cycle is basically characterized by high efficiency, low NOx emissions and low investment cost. Other advantages are quick start-up times, ready availability and compact size. Its efficiency is comparable to the combined cycle, but the absence of a bulky and expensive steam turbine makes the EvGT cycle favorable, especially in the small sizes (1-20 MW).

The EvGT concept involves the addition of water vapor to high-pressure air by humidification. Introduction of water vapor increases the mass flow rate through the expander, resulting in a higher power output and a high exhaust heat recovery potential. The heat required for humidification is mainly taken from the exhaust gas, as mentioned above, augmenting the overall cycle efficiency. Water consumption is extremely low, since sufficient humidification water is provided by exhaust gas condensation. However a small bleed-off is necessary to avoid salt enrichment.

Figure 1 shows an EvGT configuration with a tubular humidifier (TH). Only a part of the total compressed air flow, approximately 30 percent is suggested for humidification. This was first presented by Westermark (1996) and later used by Dalili & Westermark (1998) and Ågren (2000). The exhaust gas heat at high temperatures is recovered in the humid air superheater (HASH) and the boiler (BL).

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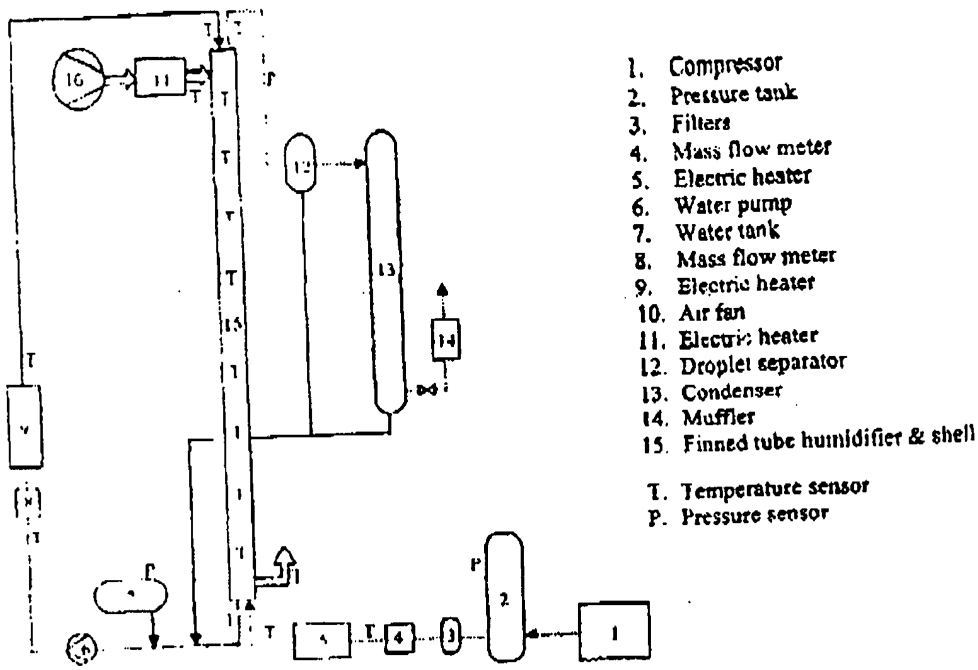

Figure 2. Tube humidifier pilot flow sheet

The remaining exhaust heat is recovered in the TH. A comparison between TH and HRSG displays that in the HRSG the exhaust gas is cooled on the shell side causing the water to boil inside the tubes. In the TH however, the heat source is the same, although at lower temperatures, while there are two phases inside the tubes, water and high-pressure air.

Humidification is subsequently carried out by bringing the high-pressure air into countercurrent contact with water, causing the water to evaporate due to the concentration gradient of water vapor in the gas phase. This process thereby comprises simultaneous heat and mass transfer across the interface between the two phases.

The humidification process permits water to evaporate on a large scale at temperatures below the boiling point, because of the lower partial pressure of water in the air-water vapor mixture. This lower partial pressure is a result of the diluting effect of the air. Thus the exhaust gas heat can be recovered down to significantly lower temperatures compared to steam generation.

The moist air (10-40% water vapor on mass dry air basis) from the humidifier is reunited with the rest of the compressed air before combustion. The steam generated in the boiler can be injected to increase the mass flow rate further. This is optional since steam may be favored elsewhere, e.g. in a pulp processing plant etc.

THE TUBULAR HUMIDIFIER CHARACTERISTICS

Tubular humidifiers have a compact design and are considered to be effective, since heat exchanging is carried out directly between the heat source (exhaust gas) and the heat sink (compressed air). Furthermore, economical considerations make the tubular humudifier favorable to other alternatives such as a packed bed and an economizer, especially in small size gas turbines (Wahlberg 2001).

Some specific features of humidifiers in EvGT systems are summerized below:

- Humidifiers operate optimally, considering the whole EvGT system, at relatively low exhaust gas temperatures.
- EvGT humidifiers operate at high pressures and high water temperatures compared to cooling towers.
- Because of elevated water temperatures, high water vapor pressures are feasible leading to high humidity levels in the air.
- Since humidification is boosted by direct exhaust gas cooling, the process is diabatic.
- Part-flow humidification is advantageous, since the required heat exchanging surface is less (Westermark 1996).
- The investment costs of tubular humidifiers are rather low compared to other components (Wahlberg 2001).

In designing humidifiers, the following factors should be taken into consideration:

- Water is sub-cooled by 10-15 °C to prevent any boiling.

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- The moist air exiting the humidifier may be assumed to be saturated and has a temperature below the inlet temperature of water.
- The exhaust gas exiting the humidifier shell has a temperature well above its dew-point temperature.
- The flow rate of compressor air and the water available in the system decides the number of tubes in the humidifier.
- Flooding must be avoided. Proper wetting of the inner tube walls is essential (Dalili & Westermark 1998).
- Minimum entrainment of water droplets in the passing compressed air is desirable. Effective droplet separation should be implemented.

Flooding in a wetted wall tube can occur at high gas rates. This condition is exhibited by a sudden large increase in the pressure drop, considerable entrainment of water droplets or surging of the liquid in the tube. In this work, the flooding velocity correlation by Alekseev (McQuillan & Whally, 1984) is applied.

The minimum liquid rate for proper wetting of a vertical plane surface, according to Perry & Green (1997), is 0.03-0.3 kg/m s water at room temperature. Since the tube diameter in this case is relatively large, the wetting rate limits above can be applied.

THE TUBULAR HUMIDIFIER PILOT PLANT

Figure 2 shows the pilot humidifier schematically. The heart of the humidifier is a vertical extended-surface tube of stainless steel with an outer and an inter diameter of 60.3 and 51.3 mm, respectively. The tube has a total length of 9.2 m, of which 8.6 m is available for heat exchanging. The remaining length is used for inlet and outlet. Its exterior surface is equipped with carbon steel rods enhancing its total heat-exchanging surface by a factor of about 7. The rods have a diameter of 6 mm and there are 332 rods with a length of 82 mm and 664 rods with a length of 68 mm per meter tube forming a quadratic cross-section. The rods are angled downwards, to decrease the pressure drop. A thin stainless steel shell (17×17 cm) with insulation surrounds the tube (figure 3).

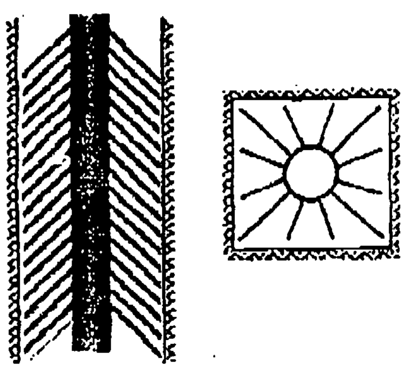

Figure 3. Extended-surface tube and shell

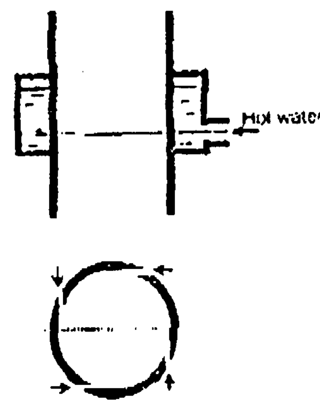

Figure 4. Humidification water inlet

A two-step compressor with inter-cooler produces pressurized air for humidification. It has a maximum flow capacity and pressure of 100 g/s and 40 bars, respectively. Two mechanical and one active carbon filter, in that order, clean the compressed air, before its pressure is reduced to desired level (5-35 bars) for each specific experiment of run. The flow rate is set by a needle valve and is measured by a mass flow meter. The mass flow meter gives also the temperature and the density of the compressed air.

The pressurized air coming from the compressor has a temperature slightly above ambient temperature. After cleaning and pressure reduction, it is heated in an electric heater to 60-150°C, to simulate an aftercooled gas turbine process. Water is fed from the top of the tube through four tangentially drilled holes, each with a diameter of 2.3 mm (figure 4). The water film formed falls continuously down the inner tube wall (figure 5). Boiling in the water film should be avoided because of the associated increased risk for entrainment. Hence the temperature of the entering water is held a few degrees below the boiling point.

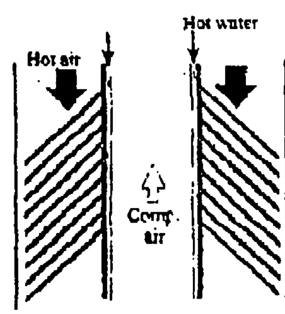

Figure 5. Flow directions in the tube and the shell

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Since the falling water film evaporates into the pressurized air, its temperature falls and its flow rate decreases gradually. Cooled falling water (80-120°C) is collected at the bottom of the tube and recirculated after addition of fresh distilled water. An electric heater (0-60 kW, max. 250°C) heats the water before entering at the top again. The water flow rate is controlled by a speed regulated gear pump and is measured by a mass flow meter (same type as above).

A temperature-regulated electric heater (0-30 kW, max 350 °C), generates hot air, simulating the exhaust gas from a gas turbine. A wing-wheeled mass flow meter measures the hot air flow rate. The hot air flows down along the tube on the shell side.

Heat is transferred from the exhaust gas to the tube wall on the shell side. The heat transfer speeds up the evaporation of the falling water film into the countercurrent pressurized air stream. Thus the humidity of compressed air increases rapidly on the tube side.

The humid air exiting the tube may contain entrainment in the shape of mist and small droplets. Generally in EvGT cycles, separation of entrainment is necessary since water contains small amount of salts that will attack the hot turbine blades, resulting in corrosion. Munters Euroform GmbH provided the droplet separator. Inside the separator humid air passes first through a wire mesh pad. Mist and small droplets colliding with the wires form bigger droplets. The humid air passes then through waved plates, where the droplets are trapped and separated.

After droplet separation, the pressurized humid air is led to a condenser, with 6-m^2 of heat exchange surface. Most of the water is condensed and recirculated back to the plant. The recirculation is optional since collecting the condensate reveals the amount of water being evaporated. The air is then expanded to atmospheric pressure by a needle valve and released to the surroundings. The mass flow rate of pressurized air is set by the same needle valve.

Thermocouples (type K) measure the temperature of water, pressurized air and hot air streams at the inlets and outlets and along the tube. The temperatures of the tube wall and in the hot air stream on the shell side are measured in one-meter intervals. The measured figures are collected in data storage for further computer processing.

Two pressure sensors at the tube inlet and outlet measure the system pressure and also indicate the pressure drop of the compressed air in the tube.

The power consumed by water heater, pressurized air heater and air heater are separately displayed. The total power consumption, after reduction of losses, is included in the energy balance relations.

This equipment is designed to operate at different gas flow rates, temperature and pressure conditions up to 35 bars.

The experimental results considering the following design parameters will be reported: heat and mass transfer coefficients; entrainment; wetting limits and flooding boundaries of the system, entrianment of water droplets and elimination of them. The results will be used for designing humidifiers for evaporative gas turbine cycles.

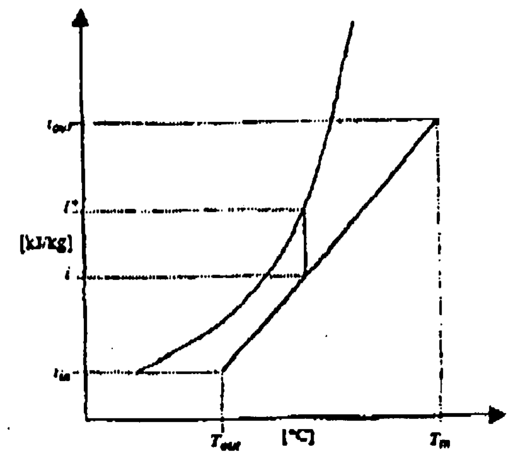

Figure 6. Humidification diagram for a packed bed humidifier

Due to limited space of this paper only a selected results at a pressure of 10 bars are reported. More extensive results will be published in the near future.

HEAT AND MASS TRANSFER MODEL

A detailed description of the modeling of simultaneous heat and mass transfer is complicated and beyond the scope of this paper. As mentioned before, humidification is a process of enhancing the water vapor content in pressurized air by bringing the two phases, compressed air and water, into countercurrent contact.

The required heat is mainly provided by transferring sensible heat from the exhaust gas on the shell side to the falling film. Latent heat (mass transfer) is conveyed into the air by evaporation, while cooling of the falling water film (additional sensible heat) also contributes to the process. It is reasonable to assume that the system is gas-film-controlled.

The equilibrium curve/working line concept is a convenient tool to describe the humidification process. Enthalpy difference is employed as the *driving force* for combined heat and mass transfer, first suggested by Mickley (1949). Figure 6 shows a humidification diagram for a packed bed humidifier. The difference in this case compared to a tubular humidifier is that the cooling of the exhaust gas with water occurs separately in an economizer. The second step is the humidification of compressor air by heated water in a packed bed. The working line is only slightly curved since there is no interaction from the exhaust gas. As will be shown later, the working line for tubular humidifier is significantly curved. The X- and Y-axis present temperature of water and humid air enthalpy respectively. The equilibrium curve describes the enthalpy of the saturated air in thermal equilibrium with the liquid water as a function of the equilibrium temperature. The enthalpy of humid air in this work is calculated using the Hyland and Wexler model for real-gas mixtures (Dalili et. al. 2001).

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Table 2. Results for the humidification tower

G_{da} (kg /s)	2.1
L_{in} (kg/s)	3.5
Pressure (bars)	8.1
d_t (m)	0.70
Packing	Montz-Pak BSH
Z (m)	0.45
N_{OG}	1.8
H_{OG} (m)	0.25

The pilot plant configuration and its components are not optimally designed or chosen. The main purpose of the pilot plant is to demonstrate that the technology works and to obtain operational experience.

The inlet water temperature is chosen to 146°C, i.e. 23°C below the boiling point. The inlet water temperature and the water flow rate to the humidifer are directly related. A lower flow rate results in a higher inlet temperature. The liquid to gas rate ratio (L/G) in the humidifier has a significant impact on the its performance. Optimal L/G value should be determined for every humidification process.

Lindquist [19] has shown that without the droplet separator a considerable amount of droplet entrainment can visibly be detected in the humidified air. Trace metals were added to the water to determine the level of entrainment. Analyzing the condensate from the exhaust gas revealed the trace metal concentration. The mean level of entrainment was determined to approximately 46 mg droplets/kg humid air [20]. This is considered low enough for a safe operation.

The impact of high moisture content

Heat capacity and thermal conductivity of humid air, with low moisture content, are only slightly pressure-dependent. Thus the changes may be neglected. The impact of pressure variation on density and diffusivity almost cancel each other. Although elevated pressures, 10-50 bars, have negligible direct effect on the heat and mass transfer characteristics, the corresponding high humidities (> 0.4 kg water vapor/kg dry air) change the composition of the humid air significantly. A large increase of the humidity leads to significant changes in the properties that are included in the calculation of the heat and mass transfer coefficients, and consequently the packing depth determination. However, driving forces are smallest at the bottom section of the column. Hence, a majority of the total number of transfer units is concentrated in that section. Therefore, the change in the composition of the humid air in the top section does not affect the total packing depth noticeably.

Enick et al. [21] have shown that the Lewis relation, commonly employed for cooling towers, can be applied even for high-pressure humidification. However, for an accurate solution, the local heat and mass transfer coefficients must be experimentally determined.

Further, with increasing humidity the deviation from ideality increases. This deviation is mainly a result of the interaction between the water molecules and the air. A large number of bulky water molecules simply prevent the gas molecules in the air from acting as an ideal gas.

CONCLUSIONS

- The pilot EvGT plant and its humidification tower is not optimally designed. Still, the humidification tower delivers humid air of relatively high water vapor content (0.19 kg water vapor/kg dry air). The height of a transfer unit (0.25 m), determined experimentally, is considered reasonable and promising.
- In most cases a maximum packing height of about 2 m should be sufficient to obtain optimal approach to the equilibrium state. This is equivalent to 5-10 transfer units as suggested in the literature.
- The existing data on packing capacity and performance, in the literature or provided by the manufacturers may be used, with due caution exercised at elevated pressures and high L/G. For air-water system the correction relations can favorably be employed.
- It is concluded that the direct impact of pressure on H_{OG} prediction for a gas-film controlled heat and mass transfer system may be neglected. However, the H_{OG} value decreases with the resultant higher temperature, and increases with the resultant higher gas flow rate, when the pressure increases. Also, the H_{OG} value decreases with increasing liquid load. Even at higher humidities, e.g. in part-flow humidification, the changes in the H_{OG} value are marginal. A series of experiments is needed to establish the exact range of H_{OG} for any packing at different pressures and mass flow-rates.
- The droplet separator is necessary for a safe operation. The type used in the pilot plant operates satisfactorily and can separate as much as 99 percent of the entrained water droplets.
- The part-flow EvGT cycle with both a humidifier and a boiler is considered to be the most favorable option, since the heat exchangers' size and cost are kept low. Additionally, the exhaust heat can be recovered even below the boiling point to significantly lower temperatures.

ACKNOWLEDGMENTS

Financial support from the Swedish National Energy Administration, Vattenfall AB, Sydkraft, E2 Energi, Elforsk and Alstom Power is gratefully acknowledged. The authors would also like to thank PhD students, Torbjörn Lindquist and Marcus Thern, for planning and executing experimental test runs.

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PTO/SB/05 (03-01)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	23IDALEX11
First Inventor	V.S. Maisotsenko et al
Title	Power System and Method
Express Mail Label No.	EU649536921US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

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1. [✔] Fee Transmittal Form (e.g., PTO/SB/17) *(Submit an original and a duplicate for fee processing)*
2. [ ] Applicant claims small entity status. See 37 CFR 1.27.
3. [✔] Specification [*Total Pages* 38] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross Reference to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to sequence listing, a table, or a computer program listing appendix
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   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
4. [✔] Drawing(s) *(35 U.S.C. 113)* [*Total Sheets* 13]
5. Oath or Declaration [*Total Pages* 3]
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6. [ ] Application Data Sheet. See 37 CFR 1.76
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ACCOMPANYING APPLICATION PARTS

9. [✔] Assignment Papers (cover sheet & document(s))
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Name	Francis L. Conte				
Address	6 Puritan Avenue				
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Country	US	Telephone	781-592-9077	Fax	781-592-4618

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	APPLICANT V.S. Maisotsenko et al	
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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE
	AA	2 1 8 6 7 0 6	01-1940	Martinks			
	AB	3 3 3 5 5 6 5	08-1967	Aguet			
	AC	3 8 7 7 2 1 8	04-1975	Nebgen			
	AD	3 9 7 8 6 6 1	09-1976	Cheng			
	AE	4 4 1 8 5 2 7	12-1983	Schlom et al			
	AF	4 8 2 9 7 6 3	05-1989	Rao			
	AG	5 2 0 3 1 6 1	04-1993	Lehto			
	AH	5 2 4 1 8 1 6	09-1993	Drnevich			
	AI	5 3 2 9 7 5 8	07-1994	Urbach et al			
	AJ	5 3 4 9 8 1 0	09-1994	Landalv			
	AK	5 7 9 0 9 7 2	08-1998	Kohlenberger			
	AL	5 8 9 4 7 2 9	04-1999	Droeschel			
	AK	6 1 7 6 0 7 5	01-2001	Griffin			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION	
							YES	NO

OTHER INFORMATION (INCLUDING AUTHOR, TITLE, PERTINENT PAGES, ETC.)

	AR	Rosen, "Evaporative Cycles - In Theori and in Practice," www 4/7/02, p: 1 & 2
	AS	Dalili, "Experimental Study on a Packed Bed Humidifier in an Evaporative Gas Turbine," IJPGC June 23-26, 2002, eight pages
	AT	Rao, "Refinery Gas Waste Heat Energy Conversion Optimization in Gas Turbines," ASME 1996, p: 473-482
	AU	Dalili, "First Expermental Results on Humidification of Pressureized Air in Evaporative Power Cycles," IECEC'01, 2001-CT-05, July 29-August 2, 2001, 7 pages

EXAMINER	DATE CONSIDERED

Law Office of
Francis L. Conte, Esquire
6 Puritan Avenue
Swampscott, MA 01907

DATE MAILED: 17 JULY 2003

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APPLICANT: V.S. Maisotsenko et al

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(1) Utility Patent Application Transmittal: 1 page
(2) Fee Transmittal for FY 2003: 1 page; and payment check
(3) Declaration ... PTO/SB/01: 3 pages.
(4) Assignment cover sheet form PTO-1595: 1 page
(5) Assignment: 1 page
(6) Power of Attorney ...PTO/SB/81: 4 pages
(7) Specification, claims, and abstract: 38 pages.
(8) Drawing containing 13 sheets and Figures 1-14.
(9) Information Disclosure Statement, Form PTO-1449: 2 pages; and
(10) References listed in PTO-1449

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